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(54) Title of the Invention: Molding Method for Hollow Container With Handle

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SPECIFICATION

1. Title of the Invention

Molding Method for Hollow Container With Handle

2. Claims

(1) A method for molding hollow containers with handles, characterized in that, in a method wherein a handle is injection molded and integrated on the circumferential surface of a hollow container after drawing/blow-molding the hollow container, a process is included wherein a cooling medium introduction rod is inserted inside the aforementioned hollow container at the time of injection molding of said handle, and cooling medium is discharged locally via said cooling medium introduction rod into the inner surface of the container opposite the regions where the handle molding resin is in contact with said hollow container.

(2) A method for molding hollow containers with handles, characterized in that, in a method wherein a handle is injection molded and integrated on the circumferential surface of a hollow container after drawing/blow-molding the hollow container, at the time of drawing/blow-molding, a lip is formed that protrudes outwards on the circumferential surface of the container on which said handle is to be molded, and subsequently, resin is loaded into a handle molding resin pathway that is delimited by the circumferential surface of the hollow container having said lip and a cavity for handle molding.

3. Detailed Description of the Invention

[Field of industrial utilization]

The present invention relates to a molding method for hollow containers with handles, and specifically, relates to a method for preventing thermal deformation of hollow containers and loss of mechanical strength in handles during the injection molding of handles.

[Prior art]

Bottles such as polyethylene terephthalate (PET) bottles that are molded by means of biaxial-drawing/blow-molding can be molded into large resin bottles, and thus bottles with handles have been molded in order to improve portability.

Methods for forming bottles with handles of this type have been disclosed in various publications such as Japanese Unexamined Patent Application No. Sho 62[1987]-181190, Japanese Unexamined Patent Application No. Sho 63[1988]-282144, Japanese

Unexamined Patent Application No. Sho 64[1989]-20126 and International Laid-Open Patent Application No. WO 90/00968 (National Publication Kohyo No. Hei 2[1990]-501556).

These methods involve injection molding of handles that are welded and integrated on hollow containers by means of carrying out biaxial drawing/injection-molding of a bottle, followed by loading handle molding resin using an annular or partially annular cavity around the circumference of this bottle.

Examples of this type of molded resin material for handles that may be used include polypropylene (PC), polyethylene (PE) and other materials that have comparatively low viscosity and comparatively low molding temperatures relative to the PET used as the bottle molding resin.

[Problems to be solved by the invention]

When the resin material for molding the handle is a resin material that has a similar molding temperature as the resin material used for molding the bottle, the following problems have been discovered.

Specifically, as a result of contact of the resin material for molding the handle with the circumferential surface of the bottle, the regions of contact with the bottle are thermally deformed due to the heat of the resin material used for molding the handle. In this case, the external appearance and quality of the bottle are compromised due to thermal deformation, or deformation of the bottle circumferential surface that delimits the handle molding resin pathway occurs, leading to leakage of the resin. In addition, strength decreases due to thermal welding under inadequate cooling in the regions of contact between the handle and bottle.

Moreover, particularly when PET is used as the handle molding resin, whitening and crystallization will occur in this area if the regions of contact between the handle and bottle cool too fast, which leads to problems with insufficient strength and loss of external appearance.

A resolution of these types of problems that has been considered is the selection of a handle molding resin with a low molding temperature. However, recent trends towards the recycling of plastics have appeared in the bottle industry as well, and molding bottles and handles from the same material or materials of similar systems is desired in order to promote recycling. In light of these considerations, the molding temperature of the resin material for molding the handle will thus be similar to the molding temperature of the bottle material.

The object of the present invention is to resolve the past problems described above by offering a molding method for hollow containers with handles, whereby insufficient cooling of the regions of contact with the handle resin as well as thermal deformation of the hollow container can be prevented, and the mechanical strength of the handle can be maintained, while providing excellent external appearance and quality, even when the hollow container and handle are formed from respective resin materials with similar molding temperatures.

[Means for solving the problems]

The first invention pertains to a method for molding hollow containers with handles, characterized in that, in a method wherein a handle is injection molded and integrated on the circumferential surface of a hollow container after drawing/blow-molding the hollow container, a process is included wherein a cooling medium introduction rod is inserted inside the aforementioned hollow container at the time of injection molding of the aforementioned handle, and cooling medium is discharged locally via the aforementioned cooling medium introduction rod into the inner surface of the container opposite the regions where the handle molding resin is in contact with the aforementioned hollow container.

The second invention pertains to a method for molding hollow containers with handles, characterized in that, in a method wherein a handle is injection molded and integrated on the circumferential surface of a hollow container after drawing/blow-molding the hollow container, at the time of drawing/blow-molding, a lip is formed that protrudes outwards on the circumferential surface of the container on which the aforementioned handle is to be molded, and subsequently, resin is loaded into a handle molding resin pathway that is delimited by the circumferential surface of the hollow container having the aforementioned lip and a cavity for handle molding.

[Action]

By means of the first invention, during injection molding of the handle, cooling medium is injected locally via a cooling medium introduction rod that has been inserted into the hollow container at the inner surface opposite to the circumferential surfaces of the hollow container that are in contact with this handle molding resin material, thereby cooling them, so that deformation of the hollow container due to the heat of the handle molding resin is prevented. In addition, because local cooling of this region can be realized, it is possible to prevent decrease in mechanical strength of the thermally welded regions due to insufficient cooling, while also preventing whitening and crystallization occurring with PET resin, as well as the decrease in mechanical strength caused thereby.

By means of the second invention, a lip that protrudes outwards is molded on the circumferential surface of the hollow container that delimits the inside resin path of the handle, and so the cross-section surface area of the handle resin path decreases, thereby decreasing the heat content of the handle molding resin material. It is thus possible to solve problems with preventing thermal deformation in hollow containers which is the same problem as in the first invention. Moreover, because the heat quantity is reduced, problems with insufficient cooling are also overcome, thereby preventing whitening and crystallization, as well as reduction in mechanical strength of the thermally welded. In addition, in the second invention, the protruding lip functions as a reinforcing material for preventing deformation of the hollow body, so that deformation of the hollow body due to resin pressure occurring during loading of the handle molding resin can be prevented.

[Working examples]

Working examples of the method of the present invention are described in detail below in reference to the diagram.

Figure 2 presents the process wherein the bottomed parison **10** is biaxially-drawn/blow-molded into a blow molding mold **16**. In this process, prior to transferring the parison into the blow molding mold **16**, the bottomed parison **10** is injection molded using PET resin with a parison injection mold, and subsequently, a temperature

conditioning process is performed and the molding is transferred to the blow molding mold **16**. Transport of the parison **10** is carried out by supporting the neck part **12** of the parison **10** using a neck mold **14** used as one of the parison injection molding molds.

The aforementioned blow molding mold **16** is constituted by two divided molds having a cavity **16a** that follows the outer shape of the final bottle **22**. A blow core mold **18** is inserted into the neck part **12** of the parison **10** situated in the blow molding mold **16**, and in addition, a drawing rod **20** that runs along the central axial direction of the blow core mold **18** is supported so that it can be freely raised and lowered. In order to perform biaxial-drawing/blow-molding of the bottle **22** using the parison **10**, the aforementioned drawing rod **20** is made to abut the inner surface of the bottom wall of the parison **10**, and while it is then driven downwards, blowing air is blown from the blow core mold **18** so that biaxial orientation in the radial direction and axial direction occurs in the parison **10**. At this point, by means of the drawing and blowing processes carried out on the bottle **22**, an annular protruding rib **24** that forms a radial protrusion along circumferential surface of the bottle **22** is molded at approximately the center position along the height of the bottle **22**.

The bottle 22 is then removed from the divided blow molding mold **16**, and is then transferred to the subsequent handle extrusion molding process by transport of the neck mold **14**.

Figure 1 presents the handle extrusion molding process.

In this figure, the handle molding mold **30** is constituted by two divided molds in the same manner as the blow molding mold **16**, and has a bottle housing cavity **32** whereby the bottle **22** can be housed. In addition, at a position below the neck part **14** of the bottle **22**, there are respective first and second molding grooves **34** and **36** in positions opposite the aforementioned annular protrusion rib **24**. The handle molding cavity 38 that connects with the first and second molding grooves **34** and **36** is formed at a location that is on the partition surface of the handle molding mold **30**.

The inner surfaces of the aforementioned first and second molding grooves **34** and **36** are formed in a shape that will yield the outer form of the handle **40** that has been injection molded, and as shown in Figure 3(A) and (B), flow stopping ribs **34a**, **24b**, **36a** and **36b** are provided on the opening end of this groove in order to stop the flow of handle molding resin material. Each of the flow stopping ribs **34a**, **34b**, **36a** and **36b** has a shape whereby it tapers off towards the front end at an angle of inclination θ (e.g., θ=45°)and is formed so that the height H_1 of the flow stopping ribs **34a** and **34b** is 0.3-0.5 mm. On the other hand, the flow stopping ribs **36a** and **36b** have a height H_2 of 0.5-1 mm. The flow stopping ribs **34a-36b** each protrude from the cavity surface of the handle molding mold **30**, and thus press on the outer surface of the bottle **22** that is situated therein so that leaking of the handle molding resin is reliably prevented by close contact with the circumferential surface of the bottle **22**.

The aforementioned handle molding mold **30** has a hot runner **48** that connects with the handle molding cavity **38**, and the handle molding resin material such as PET is loaded through this hot runner **48**, thereby allowing injection molding of the aforementioned handle **40** comprising the upper ring **42**, the lower ring **44** and the handle part **46**.

A cooling medium discharge core mold **50** is inserted and situated in the neck part **12** of the aforementioned bottle **22** situated inside the handle molding mold **30**. This

cooling medium discharge core mold **50** supports a cooling medium introduction rod **52** can be freely moved upwards and downwards along its center axis. The cooling medium introduction rod **52** has a cooling medium inlet path **54** with an end that is tightly sealed [tr. note: illegible term; alternative translation: "with an end that opens and closes"] that runs along the axial direction thereof, and also has first and second discharge openings **56** and **58** that open in multiple locations along the circumferential direction at positions opposite the first and second molding grooves **34** and **36** of the aforementioned handle molding mold **30**. In addition, the cooling medium discharge core mold **50** has an exhaust channel **60** on the circumference of the cooling medium inlet rod **52**. This exhaust channel **60** is connected to a flow metering valve **62**, and by adjusting this flow metering valve **62**, the internal pressure of the bottle **22** can be maintained at the prescribed pressure during injection molding of the handle **40**.

Next, the injection molding process for the handle **40** will be described.

The bottle **22** that is supported on a neck mold **14** is situated so that it binds tightly against the bottle housing cavity **32** of the handle molding mold **30** by means of driving closed the handle molding mold **30**, which is a divided mold. In this case, the flow stopping ribs **34a**, **34b**, **36a** and **36b** that protrude inwards from the aforementioned container housing cavity **32** are formed at the upper and lower edges of the first and second molding grooves **34** and **36**, so that the circumferential surface of this part of the bottle **22** is compressed by these respective ribs, thereby allowing a reliable tight seal between each of the ribs and the circumferential surface of the bottle **22**.

Subsequently, the cooling medium discharge core mold **50** is inserted into the neck part **12** of the bottle **22**, and in addition, the cooling medium introduction rod **52** is driven down along the cooling medium discharge core mold **50**, and is stopped at a prescribed location. This prescribed location is a location whereby the first and second discharge openings **56** and **58** in the cooling medium introduction rod **52** are opposite the first and second molding grooves **34** and **36** of the handle molding mold **30**. Next, cooling medium such as air at ambient temperature is introduced into the bottle **22** via the cooling medium introduction rod **52**. The air that is introduced into the bottle **22** via the cooling medium introduction rod **52** functions to prevent deformation (maintain the internal pressure) of the bottle **22** due to the resin pressure during injection molding of the handle **40**, and to also prevent thermal deformation of the bottle **22** due to the heat of the injection molding resin for the handle **40** (cooling action). The air that is introduced from the cooling medium introduction rod **52** is initially introduced at a pressure of, for example, 2.0 kg/cm^2. This air then fills the interior of the bottle **22**, and causes close contact of the external surface of the bottle **22** and the container housing cavity **32** of the handle molding mold **30**. In addition, this air is exhausted along the exhaust channel **60** of the cooling medium discharge core mold **50**, and by adjusting the metered flow valve **62** connected to the exhaust channel **60**, the pressure inside the bottle **22** is maintained at, for example, 18 kg/cm^2. Consequently, the internal pressure of the bottle **22** is maintained during the injection molding process for the handle **40**, so that the flow prevention ribs **34a-36b** in the first and second molding grooves **34** and **36** compress against, and are in close contact with, the outer surface of the bottle **22** at all times. By means of this action, leaking of the resin material for handle molding can be prevented.

After maintaining the internal pressure of the bottle **22** at a constant value, PET resin is introduced as handle molding resin material via a hot runner **40**. This PET resin

is introduced into the resin channel delimited by the first and second molding grooves **34** and **36** and the opposing circumferential surface of the bottle **22** via the handle molding cavity **38**, and thus injection molding of the upper ring **42**, lower ring **44** and handle part **46** occurs.

During the injection molding process for the handle **40**, localized blowing of air occurs intermittently via the first and second discharge openings **56** and **58** of the aforementioned coolant introduction rod **52**. By means of intermittent localized blowing of fresh air in this manner, sufficient cooling occurs in the region where the PET resin used as the molding resin material for the handle **40** contacts the outer surface of the bottle **22**. As a result, it is possible to prevent thermal deformation of the bottle **22** formed from PET, which is the same material as the resin material used for molding the handle. By preventing thermal deformation of the bottle **22** in this manner, an action is also provided whereby the aforementioned flow stopping ribs **34a-36b** press against the circumferential surface of the bottle **22**, thereby reliably preventing leaking of the handle molding resin material from the delimiting resin channel.

In addition, by localized blowing of fresh air, cooling of the regions of contact between the handle **40** and bottle **22** progresses, thereby allowing a reduction in the [illegible term] of the thermal weld regions between the handle **40** and bottle **22** where inadequate cooling of the contact region has occurred in the past. In particular, when PET resin has been used as the resin material for handle molding, whitening and crystallization caused by excessive cooling of the PET resin has tended to occur. However, by performing localized cooling as described in this working example, the transparency of the PET resin can be maintained, and it is possible to prevent loss of mechanical strength in the thermal weld parts resulting from whitening.

In this manner, the bottle **22** with handle **40** molded by the method of this working example has superior external appearance with little thermal deformation in the bottle **22**. Moreover, the yield of product is improved due to reduction in leakage of handle molding resin material, and moreover, it is possible to form an integrated handle **40** and bottle **22** with superior transparency and mechanical strength.

Figure 4 shows another working example of the method of the present invention.

In the figure, the bottle **70** has protruding ribs **76** and **78** that are not annular, but only partially formed at nearly the same location in the circumferential direction on the side wall **74** and shoulder **72**. Thus, the handle forming mold **80** having a bottle housing cavity **80a** that can house this bottle **70** also has a cavity **82** for handle molding that opens so that it connects with the bottle housing cavity **80a** at locations opposite to the aforementioned protruding rubs **76** and **78**. By filling the cavity **82** with resin, the handle **84** that is thereby formed does not have the upper lower rings, in contrast to the working example described above. Rather, the ends **84a** and **84b** of the handle **84** are thermally welded and integrated at two locations on the bottle **70**.

As in the working example described above, the cooling medium discharge core mold **90** has a cooling medium introduction rod **92**, and this cooling medium introduction rod **92** has a first and a second discharge opening **96** and **98**, for example, which open at locations nearly opposite the aforementioned protruding ribs **76** and **78**, which connect with the cooling medium introduction path **94** at the center. In addition, this working example is the same as the working example descried above insofar as an exhaust channel **100** is formed at the periphery of the cooling medium introduction rod **92** in the

cooling medium discharge core mold **90** and insofar as this exhaust channel **100** is connected with a flow metering valve (not shown).

In this working example, the contact regions where the handle **80** contacts the bottle **70** are not annular, but formed in sections along the circumference, but the contact regions can be locally cooled by means of air from the first and second discharge openings **94** and **96** of the cooling medium introduction rod **92**. By this means, the same action and effect as in the previous working example can be realized.

The present invention is not restricted to the above working examples, and various modification examples are possible within the scope prescribed by the invention.

For example, air was used as the cooling medium in the above working examples, and this air was also used in order to maintain the surface pressure in the bottles **70** and **22**. However, the invention is not restricted to a constitution whereby the same fluid is used for the maintenance of internal pressure and cooling. In order to increase cooling efficiency, a cooling medium that is below normal temperatures can be used, or another fluid may be used in order to maintain internal pressure.

[Effect of the invention]

The method of the present invention as described above allows localized cooling by means of discharging cooling medium via a cooling medium introduction rod onto the circumferential surface of a hollow container that is in contact with resin for molding a handle. In addition, by providing protruding ribs on the circumferential surface of the container on which the handle is to be formed, the heat contained in the handle resin material can be reduced, and reinforcement can be provided in order to prevent deformation of the container. For example, when the container and the handle are formed from the same type of resin material that has the same molding temperature, thermal deformation of the container as well as various types of damage caused by insufficient cooling of the contact regions can be prevented. As a result, hollow containers with handles can be manufactured which have improved external appearance, product quality and yields, while also providing the handle with excellent mechanical strength.

4. Brief description of the drawings

Figure 1 is a cross-sectional diagram showing a constitution whereby the handle molding process is realized in the method of a working example of the present invention.

Figure 2 is a cross-sectional diagram showing a constitution whereby the drawing blow-molding process of the container is realized.

Figure 3(A) and (B) are expanded diagrams of Figure 2(A) and (B) respectively.

Figure 4 is a cross-sectional diagram showing a constitution whereby the handle molding process is realized in the method of another working example of the present invention.

10 Parison
16 Blow molding mold
22, 70 Bottle
24, 76, 78 Protruding ribs
30, 80 Handle molding mold
40, 82 Handle
52, 92 Cooling medium introduction rod

56, 58, 94, 98 Discharge opening

Patent Agent: Hajime Inoue, Patent Attorney (and 2 others)

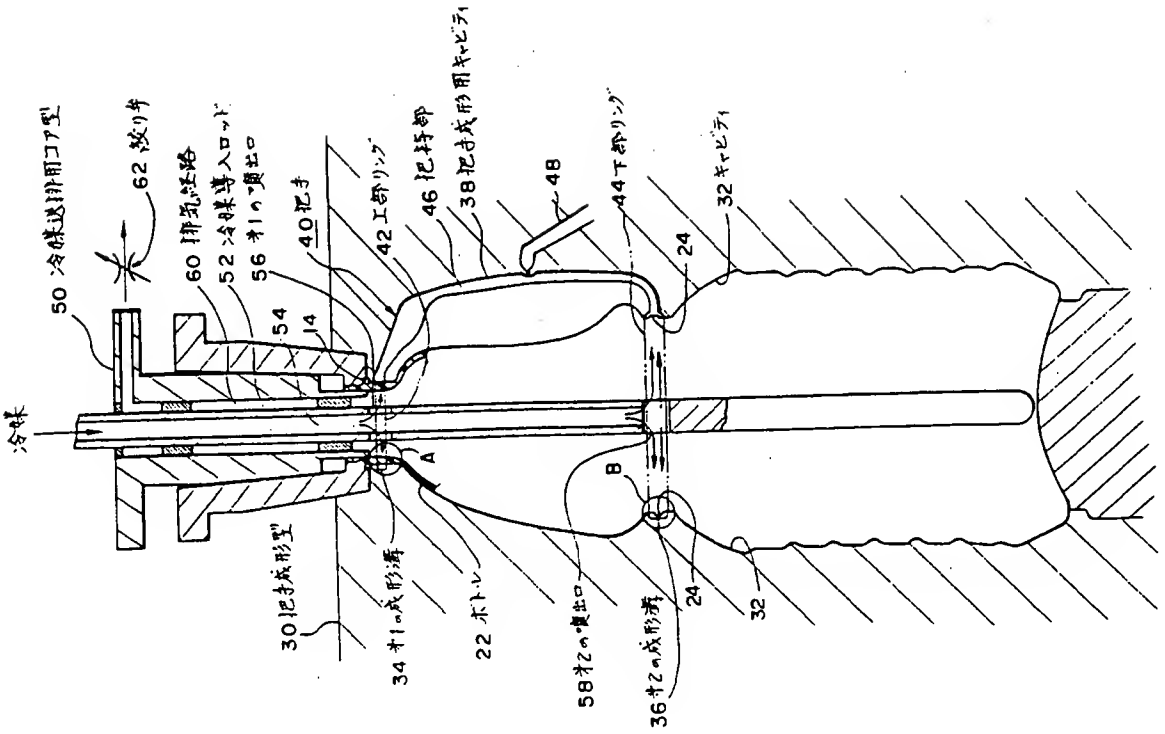
Figure 1
[top of figure:] Cooling medium
30 Handle molding mold
34 First molding groove
22 Bottle
58 2nd discharge opening
36 Second forming groove
50 Cooling medium discharge core mold
62 Flow metering valve
60 Discharge channel
52 Cooling medium inlet rod
56 First discharge opening
40 Handle
42 Upper ring
46 Handle region
38 Handle molding cavity
44 Lower ring
32 Cavity

Figure 2
16 Blow molding mold
22 Bottle
18 Blow core
14 Neck mold
20 Drawing rod
10 Parison
16a Cavity
24 Annular protruding rib

Figure 3
34a Flow stopping rib

Figure 4
70 Bottle

第1図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54
14
40 把持
42 上部リング
46 把持部
38 把持成形用キャビティ
48
44 下部リング
32 キャビティ
24
冷媒
A
B
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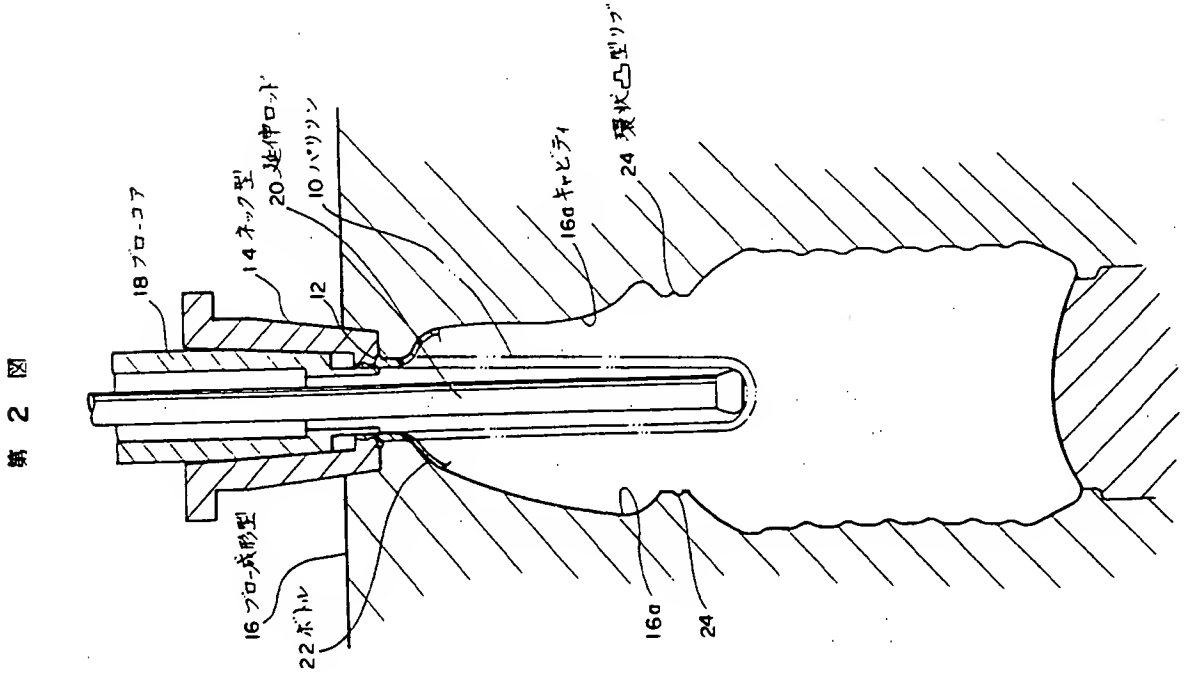
36 #2の成形溝
24
32

第2図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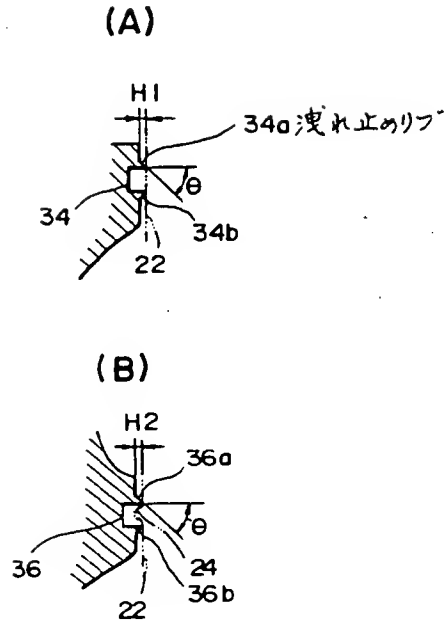
22 ポート
16a
24

第 3 図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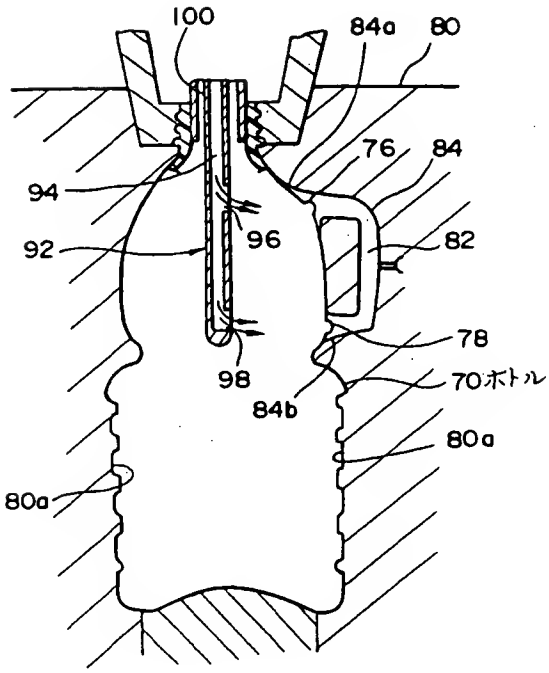
第 4 図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